



Tulsa Winch

DESIGN SERIES 004



RUFNEK 80 SERVICE MANUAL

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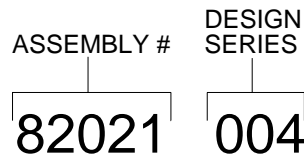
INTRODUCTION AND THEORY OF OPERATION

The Rufnek series planetary winch is designed to use a high-speed gear motor, driving through a multiple disc brake, through three planet sets to the cable drum. The multiple-disc brake is spring applied and hydraulically released through a port in the brake housing. During inhaul, the brake is not released since the load is driven through the one-way cam clutch, bypassing the brake. When the load comes to a stop, the cam clutch locks up and the load is prevented from moving by the brake.

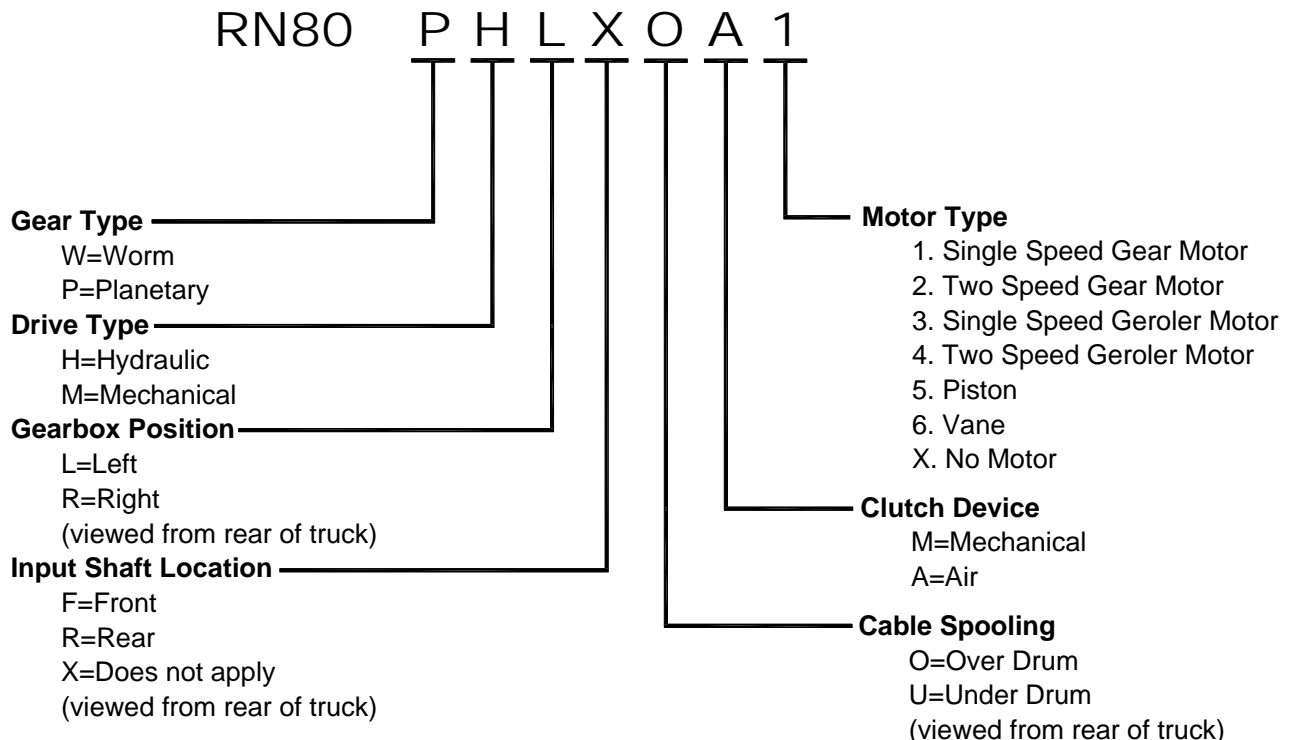
The brake and brake valve receives its signal any time the winch is in pay out. With the brake fully open at about 340 PSI the brake valve will open and dynamically control the lowering of the load.

ASSEMBLY NUMBER EXPLANATION

This manual is for design series 004. In the case of a major design change implementation, a new design series designation number will be issued for the winch. A new manual will also be created for that specific design series.



WINCH MODEL CODES








***FAILURE TO HEED THE FOLLOWING WARNINGS
MAY RESULT IN SERIOUS INJURY OR DEATH.***

The safety of the winch operator and ground personnel should always be of great concern, and all necessary precautions to insure their safety must be taken. The primary mover and the winch must be operated with care and concern for the equipment and the environment and with a thorough knowledge of the equipment and its performance capabilities must be understood. These general safety guidelines are offered, however local rules and regulations or national standards may also apply. Recommended references are, but not limited to, ANSI B30, OSHA 1910, AWS D 14.3, and SAE J706.

Additional information can be found at <http://www.team-twq.com/TulsaWinch/>

 DANGER	Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.
 WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage.
NOTICE	Indicates information or a company policy that relates directly or indirectly to the safety of personnel or protection of property.

Mounting:

Winch mounting must be secure and able to withstand the applied loads.

- The stability of the mounting system must be approved by a qualified person.
- All welding should also be done by a qualified person.
- Winch mount must be flat so as not to induce binding.
- The flatness must not exceed 1/16 inch across the mounting surface of the winch itself.

Insure that all hydraulic hoses, valves and fittings are rated to winch manufacturer's operating pressures.

Relief valves should be set to winch manufacturer's specifications.

Operator:

Must read and understand the operating and service manual.

Both the **SERVICE MANUAL** and **OPERATING AND MAINTENANCE MANUAL** are available online at <http://www.team-twg.com/TulsaWinch/>

Must never lift or move people with this winch.

This winch is not designed or intended for any use that involves moving people.

Must stay clear of the load at all times.

Ground personnel should remain a safe distance from the load and winch cable at least 1 ½ times the length of cable measured from the winch to the load.

Must stay clear of the cable at all times.

A broken cable can cause serious injury or death.

Must avoid shock loads.

Shock loads can impose a strain on the winch that can be many times the design rating.

Must be aware of the fleet angle of the winch.

All loads should only be pulled with the load line perpendicular to the drum shaft, this is to avoid excessive stresses on the winch and will help prevent the cable from building on one side of the drum flange.

Must wear personnel protective equipment (PPE) if required.

Check the local, state and federal regulations for compliance.

Must insure that the drum clutch is fully engaged before hoisting.

A visual inspection of the drum clutch engagement is required before each winching operation.

Must rig all loads secure before winching.

Pull the load line taut and inspect the condition of load for stability.

Must inspect the drum brake if equipped.

The drum brake is not a load holding device it is design to prevent over spooling of the drum and causing bird nesting of the cable on the drum. Inspect the brake for wear of the lining and the actuation method.

Must inspect the load control brake.

These winches are equipped with two (2) forms of dynamic braking. The spring-applied/hydraulically-released multi-disc oil brake is one method. Before a load is handled the load should be pulled tight and stopped to check this brake. The second method is a hydraulic lowering control. The same method should be used to check this brake.

Operation:

- All winch controls must be well marked for function to avoid confusion.
- All winch controls must be located to provide the operator with a clear view of the load.
- The clutch must be inspected daily for proper operation.
- The winch cable should be inspected daily for serviceability.
- A minimum of five wraps of tightly wound cable must remain on the drum.

MAINTENANCE

Tulsa Rufnek series planetary winches, like any other piece of machinery, need to be periodically serviced and well maintained to insure proper operation.

Good maintenance consists of four steps.

1. A daily inspection to insure that there are no oil leaks present and that all mounting bolts and other fasteners are tight, and that the wire rope is in good condition.
2. Changing the oil in both the gearbox and the brake section. *(Severity of use will determine the need for oil changes but it should be checked at a minimum of every 500 hours. Factors such as extremely dirty conditions or widely varying temperature changes may dictate even more frequent servicing).*
3. Lubing drum bushings and sliding clutch with grease thru grease fittings located on drum barrel and clutch.
4. Complete teardowns and component inspections. *(Again, severity and frequency of use will determine how often this should be done).* If the equipment that this winch is mounted to is subject to standards for this type of inspection, then those standards must be followed. If oil changes reveal significant metallic particles then a teardown and inspection must be made to determine the source of wear.

Rufnek series planetary winches are designed with a common oil reservoir for the gearbox and brake. The winches are shipped from the factory filled with Mobilube SHC SAE 75W-90 synthetic gear oil which is satisfactory for operation in ambient temperatures from -40°F to +110°F. If winch will be operated in temperatures outside this range, contact Tulsa Winch for recommendations.

The oil is drained by removing the drain plugs (85 & 81) located at bottom of adapter cover (58) and bottom of brake cover (2). Then remove the fill plugs (74 & 81) located at the top of the gear housing (60) and the top of the brake cover (2). Inspect the oil for signs of metallic particles and/or burning and dispose of in a proper manner. Then re-install the drain plugs.

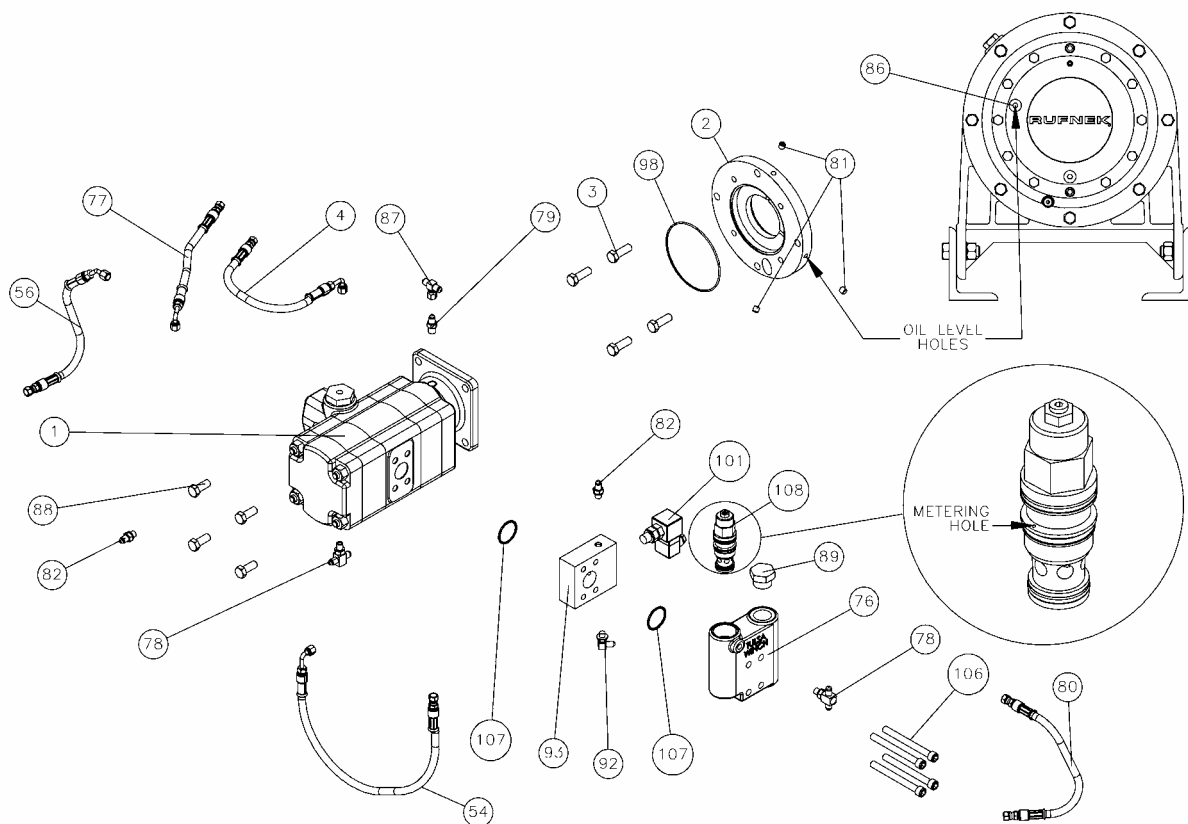
Fill the brake end with Mobilube SHC SAE 75W-90 (1/2 quart), then fill the gear end with Mobilube SHC SAE 75W-90 oil (9 quarts) and replace both of the fill plugs.

OIL CAPACITIES = 9.5 QUARTS

GENERAL DISASSEMBLY

A. MOTOR DISASSEMBLY

1. Drain the oil from the brake assembly by removing the plug (81) from the bottom of the brake cover (2).
2. Remove hoses (4, 54, 56, 77, & 80).
3. Remove the counterbalance block (76) and the manifold block (93), from the motor by removing the four cap screws (106).
4. Remove the motor from the winch by removing four capscrews (88).
5. Remove the counterbalance valve (108) from the counterbalance block (76) and inspect the metering hole to make sure it is not obstructed. Also, inspect the o-rings on valve to insure that they are not flat or cut. Replace if necessary.
6. Motors and counterbalance valves are not serviceable in the field. Return them to an authorized dealer for service.
7. Inspect o-rings (98) & (107) for damage.



B. BRAKE SECTION DISASSEMBLY

1. Evenly remove the four cap screws (3) that hold the brake cover (2) in place. Spring pressure will raise the cover up as the cap screws are loosened. Carefully remove the cover (2) from the brake housing (20). Inspect the o-ring (6) on cover for damage.
2. Remove the springs (7) from the piston (5) and check the free height. Each spring should measure at least 1.240 inches with no force on them.
3. Remove the piston (5) by installing two pieces of 3/8"-16NC all thread into the two holes in the top of the piston and run in evenly until the piston is clear of the housing. An alternate way of removing the piston is to use shop air to slowly pressurize the brake cavity to remove the piston from the brake housing (20).
4. Inspect the o-rings (8, 10) and back up rings (9, 11) on the piston, replace if necessary. Grasp the brake driver/clutch assembly (assembled items 14, 15, 17, 18, 19, 113) and remove it from the brake housing.
5. Remove the stator plates (12) and friction discs (13) from the brake housing and check them for excessive wear. Replace the parts if necessary. Be sure to check the top stator plate for scoring caused by the removal of

the piston and polish if needed. Friction discs should measure no less than .055-in. thickness and stator plates should measure no less than .068-in thickness.

6. To disassemble the brake driver/clutch assembly, remove the retaining ring (17) from either end of the driver. Then, remove the brake driver (14) and bearing (15) from the input driver (19). Next, remove the sprag clutch (18). Finally, remove the retaining ring (17) from the other end of the driver, then remove the second bearing (52) from the input driver.

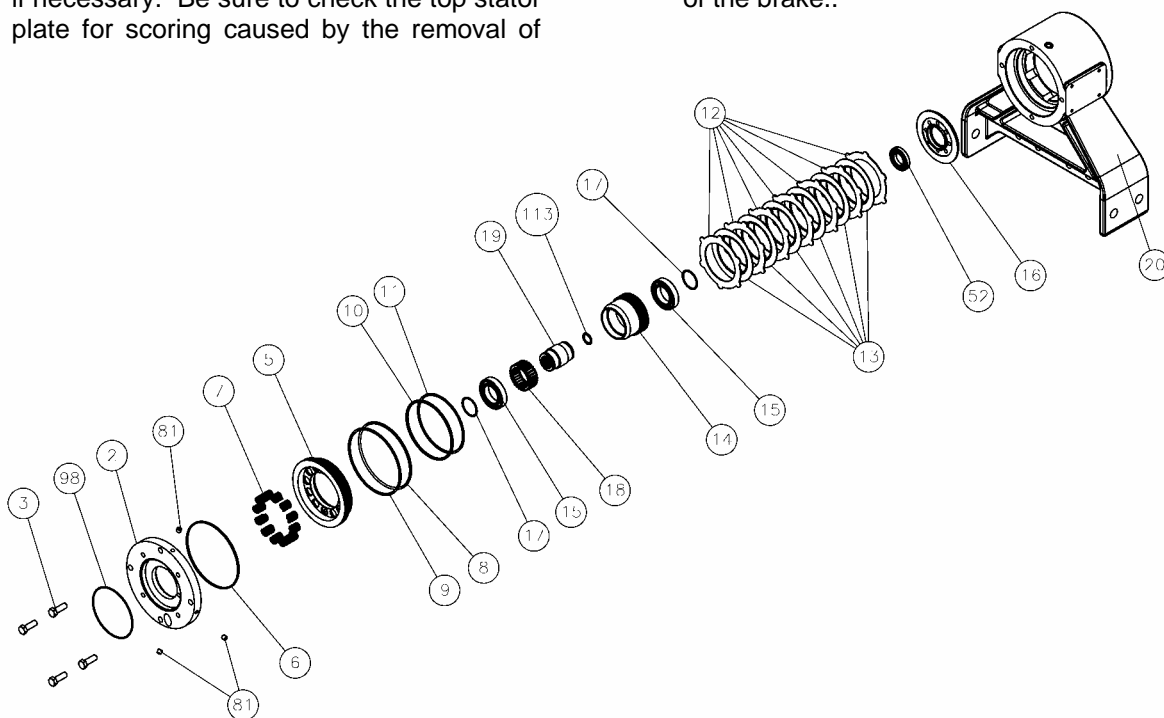


WARNING

Notice the direction of lock-up on the clutch for re-assembly.

Inspect the input driver and brake driver for wear, replace if necessary.

7. Remove the bearing housing (16) and inspect the bearing (52).
8. If the bushing or seal in the brake housing needs to be replaced, follow the drum section disassembly and reassembly sections of this manual prior to reassembly of the brake..



C. DRUM SECTION DISASSEMBLY

1. To remove the drum, first disconnect the cable from the cable clamp (35) and lay aside. If removing the drum from the motor end with the motor and brake disassembled, first remove the cotter keys (100) and clevis pins (49) connecting the yoke (67) to the bracket (90) & air cylinder (105). Second, remove the eight cap screws (29 & 69), four spacers (97), air cylinder cover (91), air cylinder (105), and bracket (90).

NOTICE

You may need to remove the air lines, so it's a good idea to mark them for re-assembly.

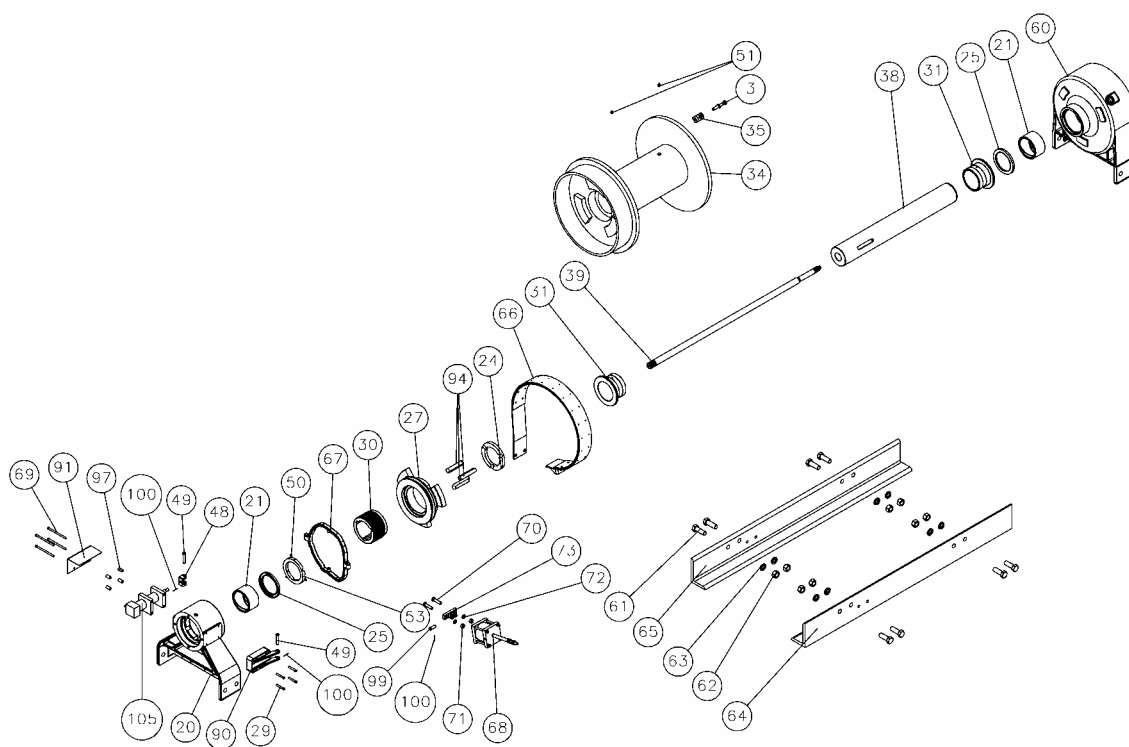
2. Support the weight of the drum with a hoist. Remove the four cap screws (61) along with the nuts and washers (63, 62) on the bottom of the brake housing (20). Disconnect the airline running from the air cylinder (68) to the brake housing (20). Remove the brake housing by sliding the housing off the output

shaft (38). At this time you will need to remove the two cap screws (70), nuts and washers (71, 72) from the frames (64 or 65). You can now remove the brake band assembly (66). Note which frame the mounting bolts are on for re-assembly. Inspect and replace if needed.

3. Remove the outer thrust collar (53) by loosening the three set screws (50).
4. Remove the yoke (67), sliding clutch (27), and coupler (30). Remove the three keys (94) and the inner thrust collar (24). Remove the drum using a hoist. Inspect the bushings (31) in both ends of the drum.

NOTICE

You should also inspect the bushing and seal (21, 25) that are located in the end of the brake housing.



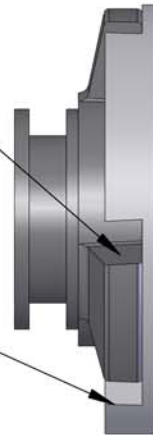
CLUTCH INSPECTION

GOOD

THIS PICTURE ILLUSTRATES
A SLIDING & DRUM CLUTCH
WITH THE PROPER REVERSE
DRAFT AND MINIMUM EDGE WEAR

CORRECT REVERSE
DRAFT ANGLE

MINIMAL EDGE
WEAR



NOTICE

THE REVERSE DRAFT
ENSURES THE CLUTCH
STAYS ENGAGED DURING
PAY-IN.

WITHOUT THE CORRECT
DRAFT, THE CLUTCH
COULD DIS-ENGAGE
UNPREDICTIBLY.

BAD

NO REVERSE DRAFT
ON THE SLIDING OR
DRUM CLUTCH

EXCESSIVE EDGE
WEAR ON BOTH
THE SLIDING
CLUTCH AND DRUM



CLUTCH REPLACEMENT CRITERIA

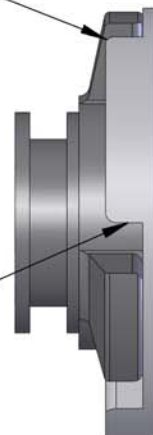


WARNING

IF 1/4 OF THE SURFACE
OF THE FACE ON THE
SLIDING CLUTCH OR DRUM
CLUTCH IS ROUNDED OR
HAS NO REVERSE DRAFT
THE SLIDING CLUTCH AND
OR DRUM CLUTCH MUST
BE REPLACED.

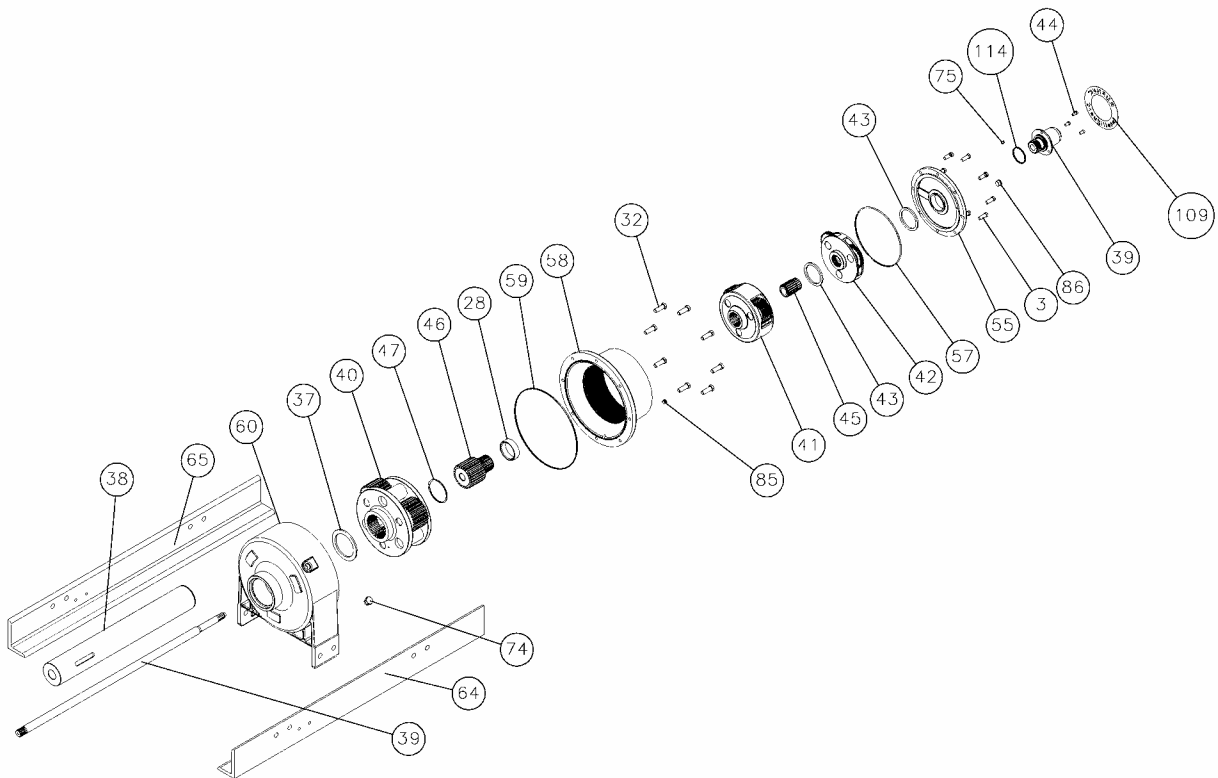
ROUNDED
FACE

NO REVERSE DRAFT
ON THE SLIDING OR
DRUM CLUTCH.



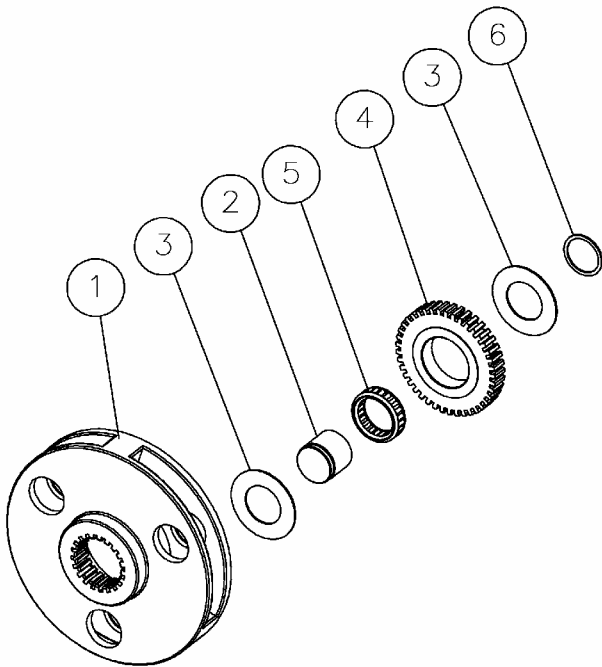
D. GEAR SECTION DISASSEMBLY

1. Drain the oil by removing the plug (85) located on the bottom of the adapter cover (58).
2. To disassemble the gear section, remove the Intelliguard™ spacer (39) from the outer cover (55) by removing three capscrews (44). Inspect the gear teeth on the Intelliguard™ (39) for wear. The Intelliguard™ system is not serviceable in the field. Return to an authorized dealer for service.
3. Remove the outer cover (55) by removing the ten capscrews (112).
4. Inspect the o-rings (57 & 114) for wear and replace if necessary
5. Remove the input gear set (42) along with the inner and outer thrust washers (43). Inspect and replace if necessary.
6. Remove the sun gear (45) and secondary gear set (41). Inspect and replace if necessary.
7. Remove the primary housing (58) by removing eight capscrews (32). Inspect the o-ring (59) and replace if necessary.
8. Remove the spacer (28) and sun gear (46). Inspect for wear and replace if necessary.
9. Remove the snap ring (47) from the output shaft (38).
10. Remove the output gear set (40) and thrust washer (37). Inspect and replace if necessary.



E. INPUT PLANET SET DISASSEMBLY

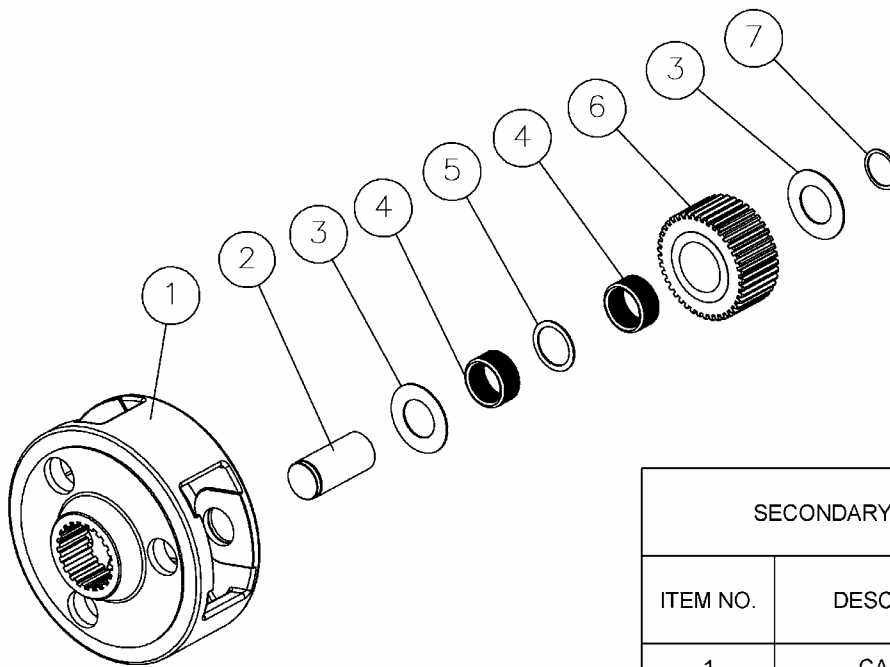
1. Remove the retaining rings (6) from the carrier (1).
2. Remove the planet pins from the carrier (1) by carefully tapping them out.
3. Remove the planet gears (4), thrust washers (3), and bearings (5) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.



INPUT GEAR SET (42)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET PIN	3
3	WASHER	6
4	PLANET GEAR	3
5	BEARING	3
6	RETAINING RING	3

F. SECONDARY PLANET SET DISASSEMBLY

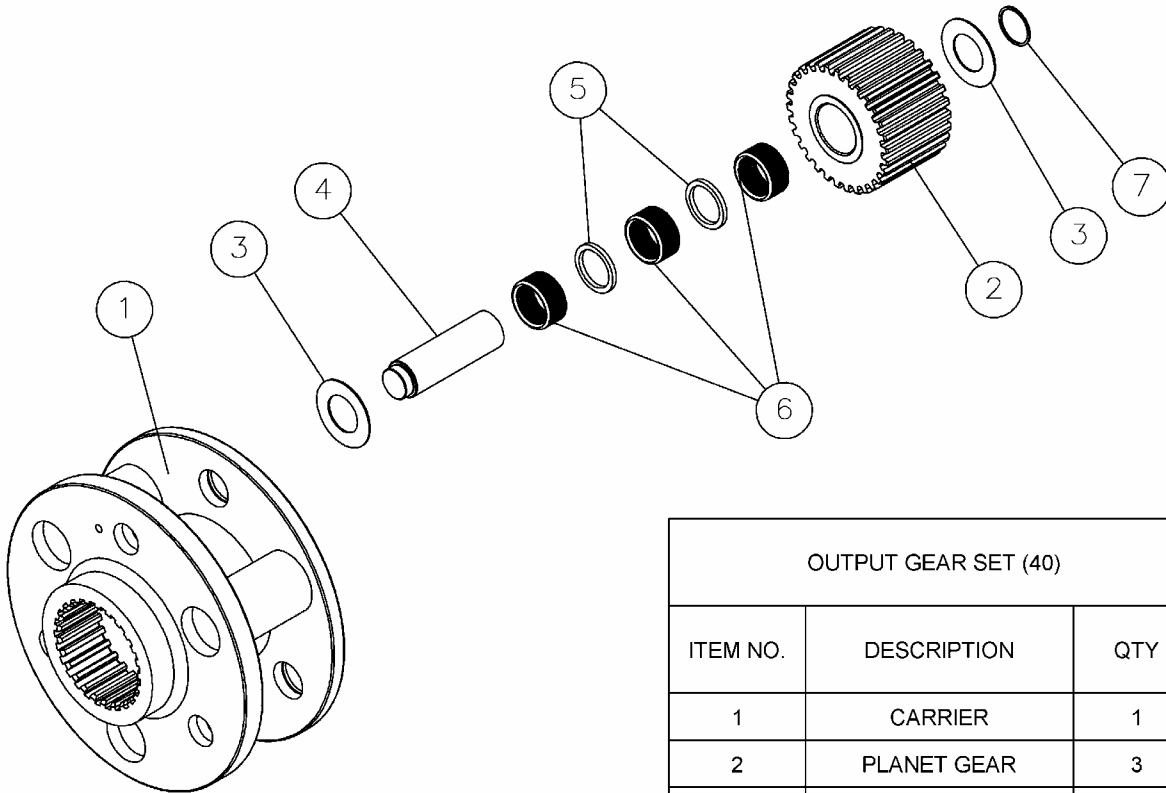
1. Remove the retaining rings (7) from the carrier (1).
2. Remove the planet pins (2) from the carrier (1) by carefully tapping them out.
3. Remove the planet gears (6), thrust washers (3), bearings (4), and spacers (5) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.



SECONDARY GEAR SET (41)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET PIN	3
3	WASHER	6
4	BEARING	6
5	SPACER	3
6	PLANET GEAR	3
7	RETAINING RING	3

G. OUTPUT PLANET SET DISASSEMBLY

1. Remove the retaining rings (7) from the carrier.
2. Remove the planet pins (4) from the carrier (1) by carefully tapping them out.
3. Remove the planet gears (2), thrust washers (3), bearings (6), and spacers (5) from the carrier.
4. Inspect the parts for wear or damage and replace if necessary.



OUTPUT GEAR SET (40)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET GEAR	3
3	WASHER	6
4	PLANET PIN	3
5	SPACER	6
6	BEARING	9
7	RETAINING RING	3

GENERAL ASSEMBLY

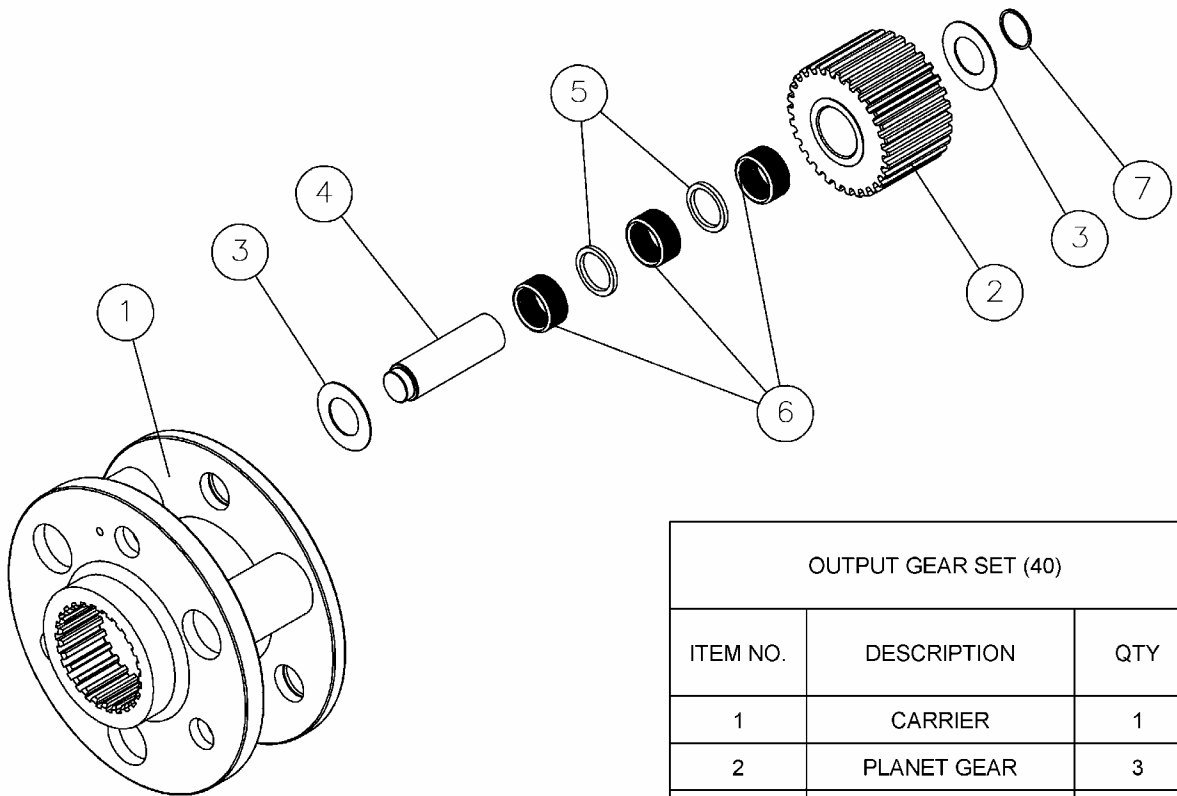
H. OUTPUT PLANET SET ASSEMBLY

1. Insert the gears (2), bearings (6), spacers (5) and thrust washers (3) into the carrier (1).
2. Being careful to line up the thrust washers (3) and bearings (6) with the planet pins (4), press the pins into the carrier.
3. Replace the retaining rings (7).



CAUTION

If the pins are not lined up properly, the thrust washer can be shattered during the pressing operation.



OUTPUT GEAR SET (40)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET GEAR	3
3	WASHER	6
4	PLANET PIN	3
5	SPACER	6
6	BEARING	9
7	RETAINING RING	3

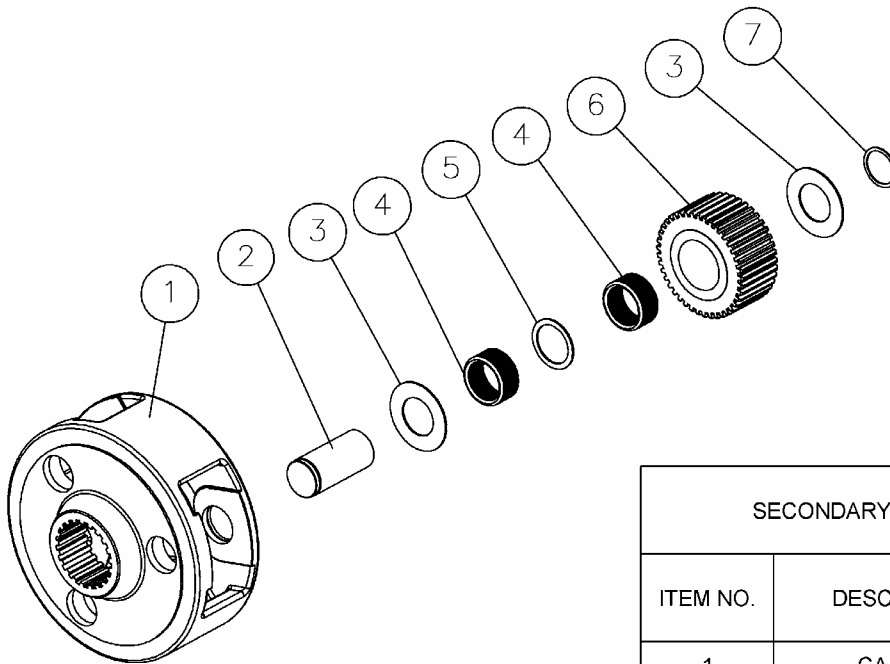
I. SECONDARY PLANET SET ASSEMBLY

1. Insert the gears (6), bearings (4), spacers (5), and thrust washers (3) into the carrier (1).
2. Being careful to line up the thrust washers (3) and bearings (4) with the planet pins (2), press the pins into the carrier.
3. Replace the retaining rings (7).



CAUTION

If the pins are not lined up properly, the thrust washer can be shattered during the pressing operation.



SECONDARY GEAR SET (41)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET PIN	3
3	WASHER	6
4	BEARING	6
5	SPACER	3
6	PLANET GEAR	3
7	RETAINING RING	3

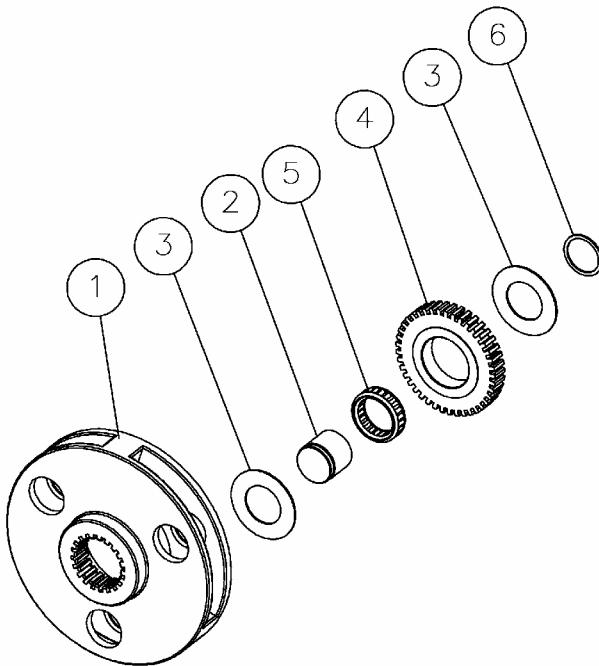
J. INPUT PLANET SET ASSEMBLY

1. Insert the gears (4), bearings (5) and thrust washers (3) into the carrier (1).
2. Being careful to line up the thrust washers (3) and bearings (5) with the planet pins (2), press the pins into the carrier (1).
3. Replace the retaining rings (6).



CAUTION

If the pins are not lined up properly, the thrust washer can be shattered during the pressing operation.



INPUT GEAR SET (42)		
ITEM NO.	DESCRIPTION	QTY
1	CARRIER	1
2	PLANET PIN	3
3	WASHER	6
4	PLANET GEAR	3
5	BEARING	3
6	RETAINING RING	3

K. GEAR END ASSEMBLY

1. Bolt the gear-housing (60) loosely into both frames (64, 65).
2. When reassembling, apply grease to parts such as thrust washers, o-rings, and seals. Install the output shaft (38) into the gear housing (60). Slide the thrust washer (37) onto the output shaft (38). Next, install the output gear set (40). Then install the retaining ring (47) onto the output shaft (38). Push the gear set and shaft back into the housing until it stops against the thrust washer (37).

NOTICE

Make sure to line up all three planet gears in the output gear set with the gear housing as it starts into the housing.

3. Install the sun gear (46) and spacer (28).
4. Install the primary housing (58) onto the gear housing (60) with eight capscrews (32), making sure not to damage the o-ring (59), and torque them to specification (see page 27 of this manual).
5. Install the secondary gear set (41).

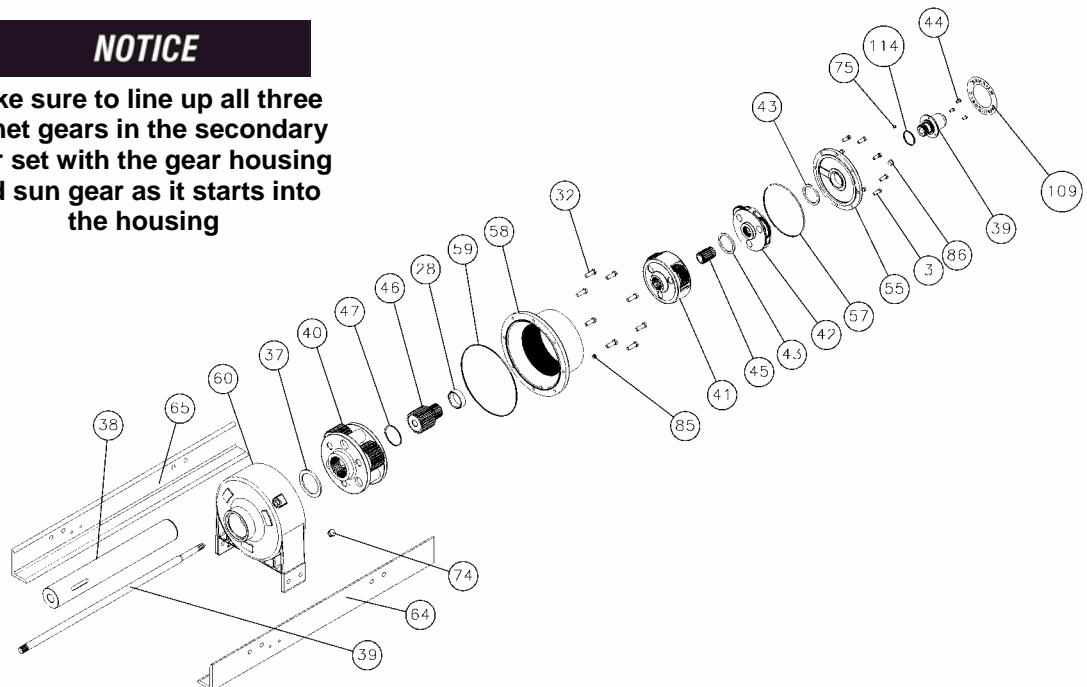
NOTICE

Make sure to line up all three planet gears in the secondary gear set with the gear housing and sun gear as it starts into the housing

6. Install the secondary sun gear (45).
7. Install the inner thrust washer (43) onto the input gear set (42). Insert the input gear set (42) into the ring gear (22) making sure it is against the thrust washer (43). Put the outer thrust washer (43) in place and slide the input shaft (39) through the sun gears and output shaft (38). Let the input shaft protrude out on the gear end so that all of the spline is showing.
8. Put the cover (55) on and secure it with eight capscrews (3), being careful not to damage the o-ring (59). Install the Intelliguard™ sensor (39) into the cover (55) with three capscrews (44), again making sure not to damage the o-ring (114), add locktite and secure it with three capscrews. (44)

NOTICE

Make sure the input shaft engages the gear in the Intelliguard™ correctly.



L. DRUM SECTION ASSEMBLY

1. After inspecting and replacing the necessary parts, such as the drum bushings (31). Install the drum (34) onto the output shaft (38). This part is very heavy and you will need the assistance of a hoist. With the weight of the drum supported, install the brake band assembly (66) along with the bracket (73), capscrews (70), nuts (71), and washers (72).

NOTICE

You may need to lower the drum to align the holes in the brake band with the holes in the frame.

2. Install the brake band air cylinder (68), making sure the rod of the air cylinder (68) is going through the bracket on the brake band (66). Secure it to the bracket (73) with the clevis pin (99) and cotter key (100). Tighten the adjusting nut on the air cylinder shaft until there is not space between the drum

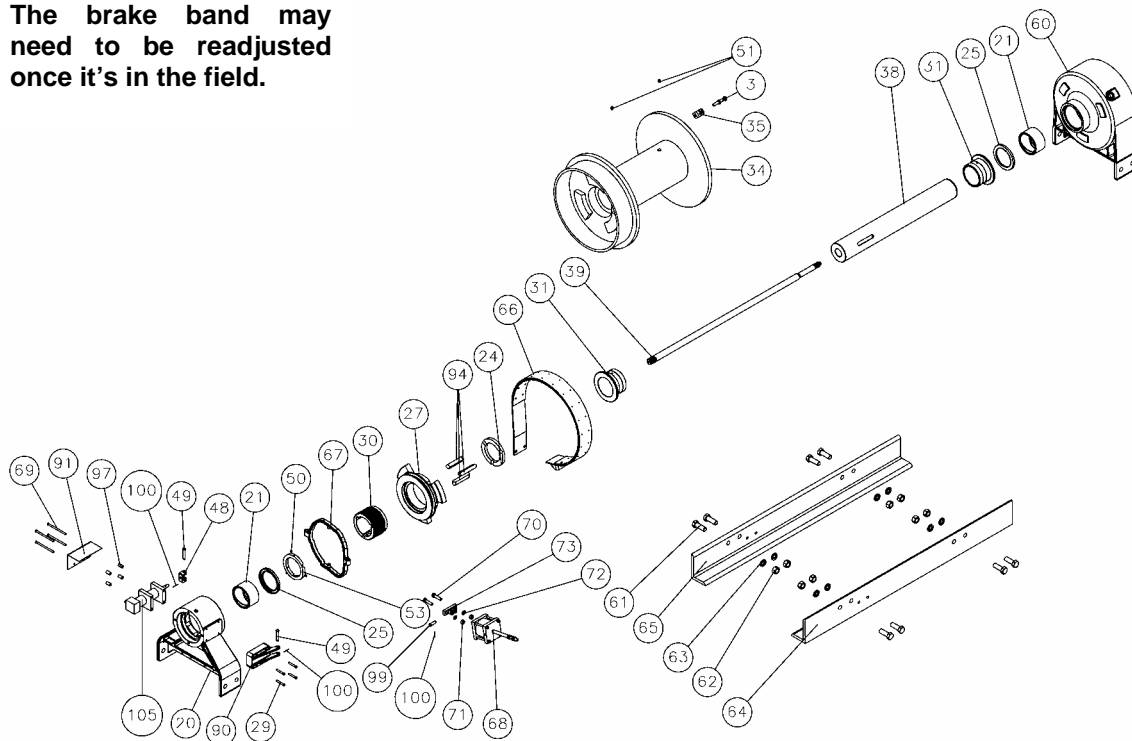
(34) and the brake band (66). Then, tighten the jam nut to secure the adjusting nut.

3. Install the inner thrust collar (24) making sure the half-moon slots are lined up with the key slots in the output shaft (38). Tap the three keys (94) into their slots in the output shaft.
4. Align the coupler (30) with the keys (94) and slide it onto the output shaft (38). Install the sliding clutch (27) and yoke (67) onto the coupler (30).
5. Install the outer thrust collar (53), aligning the half moon slots with the keys (94). Tightly hold the thrust collar (53) against the keys and lock down the three set screws (50).
6. Slide the brake housing (20) onto the output shaft (38).

(Continued on page 19)

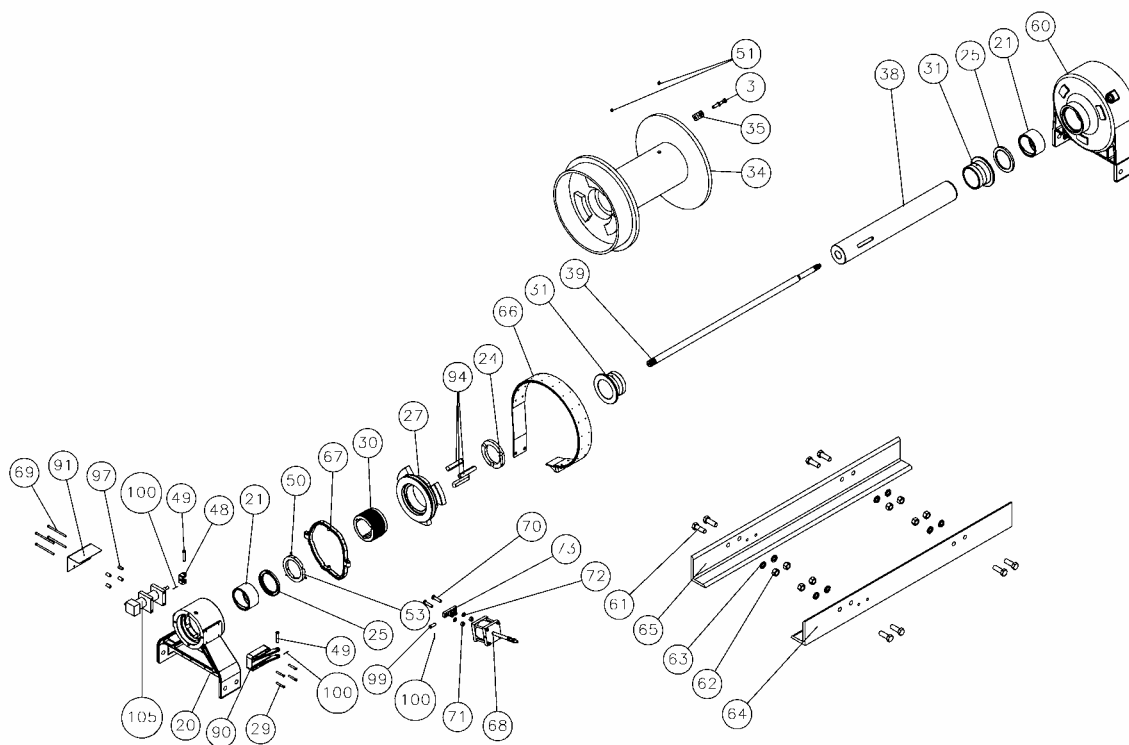
NOTICE

The brake band may need to be readjusted once it's in the field.



DRUM SECTION ASSEMBLY CONTINUED

7. Bolt the brake housing (20) loosely into both frames (64, 65). Lower the drum so the weight of the drum is supported by both the brake and gear housings. The air line from the brake band air cylinder can be attached at this time.
8. Disengage the sliding clutch (27) so you can turn the drum freely and tighten all bolts through the frames to the proper torque specification (see page 27 of this manual).
9. Turn the drum to make sure it is not binding.
10. If necessary, install the air cylinder (105) and the air cylinder cover (91) to the brake housing with four capscrews (69) and spacers (97).
11. Install the bracket (90) to the brake housing using four capscrews (29).
12. Attach the yoke (67) by installing clevis pins (49) into the bracket (90) and clevis (48). Install cotter keys (100) to clevis pins (49) to secure their positions. Connect shop air to the cylinder and apply air in both directions. With the clutch fully engaged (air applied), there should be slight movement on the clutch plate in both directions. Adjust clevis (48) and air cylinder jam nut accordingly.



M. BRAKE SECTION ASSEMBLY

- NOTICE**

5. Install the piston (5) into the brake housing (20) and gently tap it down until it is seated making sure not to damage the o-rings (8, 10) or back-up rings (9, 11).

- making sure not to damage the o-rings (8, 10) or back-up rings (9, 11).
-
- This exploded view diagram illustrates the assembly of a mechanical component, likely a pump or valve. The parts are numbered 1 through 20. The assembly sequence starts with the base plate (1) and mounting bracket (20). A large O-ring (8) and back-up ring (9) are installed on the base. A central shaft (12) is then inserted, followed by a series of seals and rings including O-rings (10, 11), back-up rings (13, 14), and a spring (15). The final assembly is secured with a cap (16) and a locking nut (17). The diagram also shows a separate component (18) and a small O-ring (19).

N. MOTOR ASSEMBLY

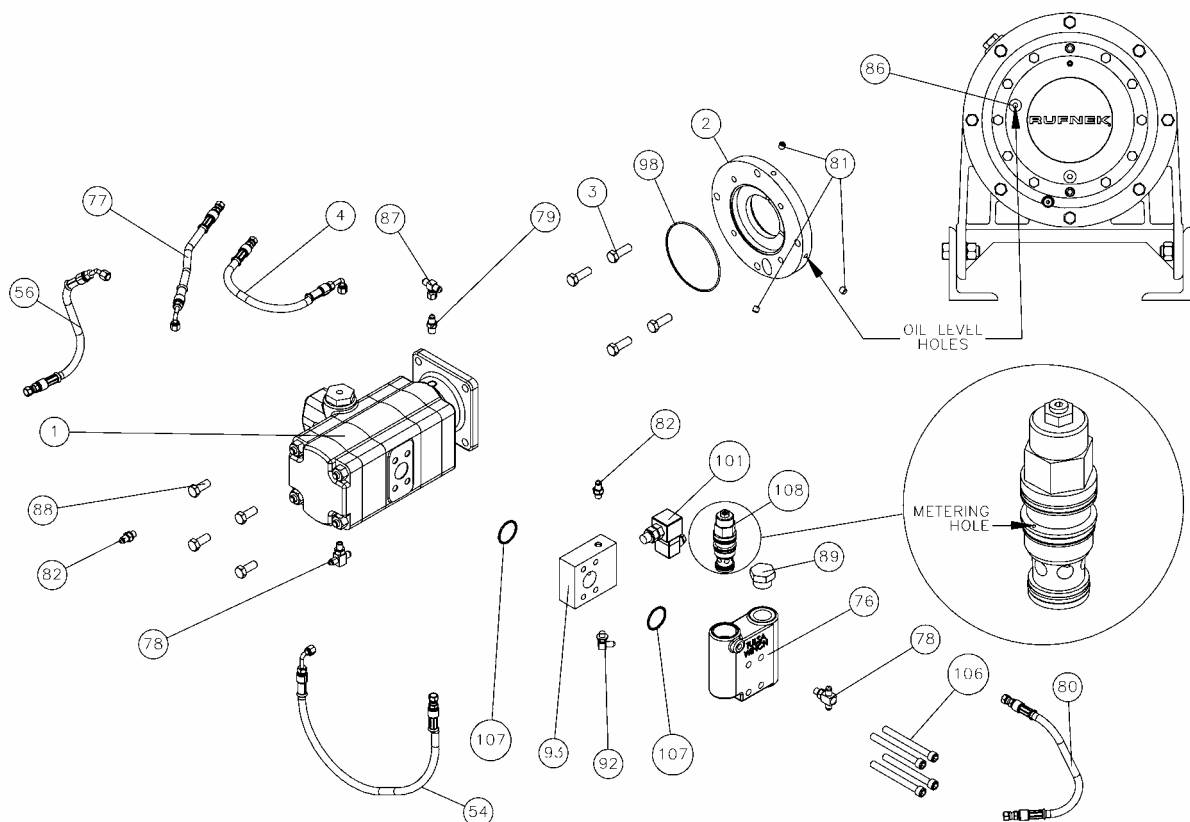
1. Install the o-ring (98) then the motor (1) and secure it with four capscrews (88). Tighten the capscrews to the proper torque specification (see page 27 of this manual).

NOTICE

Make sure you install the motor with the belly of it down and the case drain port up.

2. If removed, install cartridge valve (101).
3. Install the o-ring (107) into the manifold block (93) and counterbalance block (76).
4. Install the counter-balance valve (108) into the counterbalance block (76).

5. Install the manifold block (93) and counterbalance block (76) using four capscrews (106).
6. Install hoses (4, 54, 56, 77, and 80).
7. Remove the oil level plugs (81 & 86) from the brake cover (2) and gearbox cover (55). Fill the brake and gearbox through the oil fill hole located on top of the gearbox with the proper oil until the oil reaches the oil level holes. Replace the oil level plugs. (See page 5 of this manual).



TROUBLESHOOTING

FAILURE	PROBABLE CAUSE
Winch won't hold load.	<ul style="list-style-type: none"> a) Excessive back pressure in the system. Check the system for restrictions and reduce the backpressure. b) Brake discs are worn out. Replace brake discs. c) Winch clutch is slipping. Inspect the clutch and driver for wear and replace worn parts.
Winch will not raise the load it should.	<ul style="list-style-type: none"> a) Relief valve setting may be too low to allow proper lifting. Increase relief valve pressure setting. <i>(Note: Do not exceed recommended system pressures.)</i> b) Load being lifted may be more than the winch's rating. Reduce the load or re-rig to increase mechanical advantage.
Oil leaks from the vent located on the top of the gearbox	<ul style="list-style-type: none"> a) The motor shaft seal may have failed. Replace this seal and reduce backpressure if that caused the shaft seal to fail. b) Brake piston seals may have failed. Service the brake section and replace worn parts.
Winch runs too slow	<ul style="list-style-type: none"> a) Low flow rate. Check the flow rate and increase if necessary. b) Hydraulic motor worn out. Replace the motor.
Cable drum won't free spool	<ul style="list-style-type: none"> a) Winch not mounted squarely. Check mounting and confirm that the winch is mounted on a level surface. b) Clutch not disengaged. Disengage the clutch.

RUFNEK 80 BILL OF MATERIAL

SEQ	QTY	P/N	DESCRIPTION
1	1	43152	HYDRAULIC MOTOR
2	1	43419	BRAKE COVER
3	6	28060	CAPSCREW
4	1	42494	HOSE ASSEMBLY
5	1	42942	BRAKE PISTON
6	1	33094	O-RING
7	12	42230	BRAKE SPRING
8	1	32186	O-RING
9	1	42337	BACK-UP RING
10	1	42335	O-RING
11	1	42336	BACK-UP RING
12	7	42148	STATOR PLATE
13	6	32765	FRICTION DISC
14	1	44335	BRAKE DRIVER
15	2	29162	BEARING
16	1	44338	BEARING HOUSING
17	2	44323	RETAINING RING
18	1	41759	CLUTCH
19	1	44337	INPUT DRIVER
20	1	44420	BRAKE HOUSING
21	2	44439	BUSHING
22	-	-	OMIT
23	-	-	OMIT
24	1	42938	THRUST COLLAR
25	2	44690	OIL SEAL
26	3	994188	THRUST RACE
27	1	44576	SLIDING CLUTCH
28	1	44498	SUN GEAR SPACER
29	4	29614	CAPSCREW
30	1	44422	COUPLER
31	2	42868	BUSHING
32	8	30204	CAPSCREW
33	2	33324	WASHER
34	1	44423	WELDMENT DRUM
35	1	44424	CABLE CLIP
36	-	-	OMIT
37	1	44425	THRUST WASHER
38	1	44426	OUTPUT SHAFT
39	1	4479	INTELLIGUARD SYSTEM
40	1	4397	OUTPUT GEAR SET
41	1	4399	SECONDARY GEAR SET
42	1	4398	INPUT GEAR SET
43	2	44428	THRUST WASHER

RUFNEK 80 BILL OF MATERIAL CONTINUED

SEQ	QTY	P/N	DESCRIPTION
44	3	32477	CAPSCREW
45	1	44430	SECONDARY SUN GEAR
46	1	44431	OUTPUT SUN GEAR
47	1	43699	RETAINING RING
48	1	43828	CLEVIS
49	2	43827	CLEVIS PIN
50	3	21653	SET SCREW
51	2	21128	ZERK GREASE FITTING
52	1	42932	BALL BEARING
53	1	43696	THRUST COLLAR
54	1	43459	HOSE ASSEMBLY
55	1	44736	COVER
56	1	42495	HOSE ASSEMBLY
57	2	28933	O-RING
58	1	44727	PRIMARY HOUSING
59	1	29496	O-RING
60	1	44419	GEAR HOUSING
61	8	30203	CAPSCREW
62	8	20318	NUT
63	8	20559	LOCKWASHER
64	1	44434	RIGHT HAND FRAME
65	1	44435	LEFT HAND FRAME
66	1	44461	BRAKE BAND
67	1	43882	CLUTCH YOKE
68	1	42929	BRAKE BAND AIR CYLINDER
69	4	43880	CAPSCREW
70	2	20525	CAPSCREW
71	2	20521	NUT
72	2	20518	LOCKWASHER
73	1	42955	AIR SHIFT MOUNTING BRK.
74	1	31582	O-RING PLUG
75	1	13050	BREATHER
76	1	42029	1200W COUNTERBALANCE BLOCK
77	1	42031	HOSE ASSEMBLY
78	2	42438	STRAIGHT THREAD BRANCH TEE
79	1	40280	FITTING
80	1	42030	HOSE ASSEMBLY
81	4	21684	PLUG, PIPE
82	2	41838	STRAIGHT ADAPTER
83	-	-	OMIT
84	1	43834	AIR SHIFT TUBING & FITTING KIT
85	1	42392	O-RING PLUG
86	2	43402	O-RING PLUG
87	1	42033	SWIVEL TEE

RUFNEK 80 BILL OF MATERIAL CONTINUED

SEQ	QTY	P/N	DESCRIPTION
88	4	20524	CAPSCREW
89	1	32411	HEX PLUG
90	1	43877	CLUTCH BRACKET
91	1	43835	AIR CYLINDER COVER
92	3	42089	90° ADAPTER
93	1	43368	MANIFOLD BLOCK
94	3	44436	SHAFT KEY
95	-	-	OMIT
96	-	-	OMIT
97	4	43078	SPACER
98	1	34003	O-RING
99	1	939243	CLEVIS PIN
100	3	20514	COTTER PIN
101	1	43367	12 VOLT CARTRIDGE VALVE
102	-	-	OMIT
103	-	-	OMIT
104	-	-	OMIT
105	1	44340	AIR CYLINDER
106	4	43372	CAPSCREW
107	2	32182	O-RING
108	1	41867	COUNTERBALANCE VALVE
109	1	44736	INTELLIGUARD™ LOGO PLATE
110	-	-	OMIT
111	-	-	OMIT
112	-	-	OMIT
113	1	29043	RETAINING RING
114	1	31543	O-RING
115	-	-	OMIT

VISCOSITY CHART



SUS VISCOSITY @100°F	KINEMATIC VISCOSITY CENTISTOKES (cSt@40°C)	ISO (cSt)	AGMA NUMBER	SAE CRANKCASE OIL	SAE GEAR OIL
9000	1500	1500	9		
8000					
7000					
6000	1000	1000	8A		250
5000	900				
4000	800				
3000	700	680	8		
2500	600				
2000	500				140
1500	400	460	7		
1000	300	320	6		
900	200	220	5	50	90
800	175				
700	150	150	4	40	
600	125				
500	100	100	3	30	85W
400	80				
300	70	68	2		80W
200	60				
150	50	46	1	20W-20	
100	40				
50	30	32	0		75W
	20	22		10W	
	15	15		5W	
	10	10		0W	
	5	7			
		5			
		3			
		2			



TORQUE SPECIFICATIONS CHART

Nominal	Size	Dry SAE Grade 5 Torque *(Ft-Lbs)	Plated SAE Grade 5 Torque *(Ft-Lbs)	Lubricated SAE Grade 5 Torque *(Ft-Lbs)	Dry SAE Grade 8 Torque *(Ft-Lbs)	Plated SAE Grade 8 Torque *(Ft-Lbs)	Lubricated SAE Grade 8 Torque *(Ft-Lbs)
1/4	20	8	6	5	12	9	7
1/4	28	10	7	6	14	10	8
5/16	18	17	13	10	25	18	15
5/16	24	19	14	11	27	20	16
3/8	16	31	23	19	44	33	26
3/8	24	35	26	21	49	37	30
7/16	14	49	37	30	70	53	42
7/16	20	55	41	33	78	58	47
1/2	13	76	57	45	106	80	64
1/2	20	85	64	51	120	90	72
9/16	12	109	82	65	153	115	92
9/16	18	122	91	73	172	129	103
5/8	11	150	113	90	212	159	127
5/8	18	170	128	102	240	180	144
3/4	10	266	200	160	376	282	226
3/4	16	297	223	178	420	315	252
7/8	9	430	322	258	606	454	364
7/8	14	474	355	284	668	501	401
1	8	644	483	386	909	682	545
1	14	721	541	433	1019	764	611
1-1/8	7	794	596	475	1288	966	772
1-1/8	12	890	668	534	1444	1083	866
1-1/4	7	1120	840	672	1817	1363	1090
1-1/4	12	1241	930	745	2012	1509	1207

T = BOLT TORQUE (LB. FT.)

$T = (KWD) / 12$

K = TORQUE COEFFICIENT (K = 0.20 DRY K = 0.15 PLATED K = 0.12 LUBRICATED)

W = PRELOAD TENSION

D = NOMINAL BOLT SIZE (IN.)

* ALL TORQUE VALUE TOLERANCES ARE $\pm 5\%$

RUFNEK 80 ISOMETRIC DRAWING

